

CONSIDERED DESIGN CHANGES - WEIGHT REDUCTION (REV. 3)  
"20 September 1960"

<u>Item</u>	<u>Current</u>	<u>Proposed Changes (lbs.)</u>			
	<u>Est. Wt. (lbs)</u>	<u>Cat. 1</u>	<u>Cat. 2</u>	<u>Cat. 3</u>	<u>Cat. 4</u>
1. <u>Compressor Inlet Section</u>	"105.6"				
(a) Remove thrust balance seal (see rotor item 3 (d) )			"(-2.4 incorporated)"		
(b) Titanium inlet case			"(-36.7 incorporated)"		
(c) Redesign #1 bearing compartment			-3		
"Notes: -1.9 revised estimate." + .6 other changes."					
2. <u>Compressor Stator</u>	"434.1"				
(a) Change 1st Stage comp. case, vanes to Titanium			"(-26.5 incorporated)"		
(b) Thin inner by-pass gap fairing			"(-5.8 incorporated)"		
"(c) Redesign interstage seals"					"NA "
"(d) Reduce case material due to reduced maneuver loads."			"-1.9 " "prel. "		
"Notes: +18.4 revised estimate." + 4.5 other changes."					
3. <u>Compressor Rotor</u>	"1096.9"				
(a) Astroloy compressor disc					-76** prel.
(b) Thin rotor flanges					-2.5
(c) Incorporate Inco 718 in blades and shorten rotor					-18 prel.

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(d) Remove 1st Stage inlet seal		"(-2.3 incorporated)"			
(e) Titanium 1st stage blade		"(-33.5* incorporated)"			
(f) Trussed front hub in Waspaloy with Titanium blades		"(-33.3 incorporated)"			
(g) Integral Spacers on 9th disc and shorter bolts		"(-12.9 incorporated)"			
(h) Taper 9th stage seals		(-.2 incorporated)			
(i) Remove rear hub excess material		-4 prel.			
(j) Redesign discs 2 thru 4 to remove excess for gyro and pressure and add rim spacer.		"(+9.1 incorporated)"			
"Note: +.5 revised estimate."					
4. <u>Compressor Miscellaneous</u>	6				
5. <u>Diffuser Section</u>	122.7"				
(a) Lighten struts		"(-1.6 incorporated)"			
(b) Redesign #2 bearing and bearing compartment		-24 prel.			
(c) Redesign tower shaft gearing		-4.6			
(d) Lightened bosses		(proposal dropped)			
"(e) Redesign 9th stage seals and leakage manifold."		"-3.0"			
"(f) Lighten stiffening rings"		"-4.5" prel.			

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"(c) Lighten stiffening rings and case due to reduced maneuver loads"		"-2.4"			
"Note: +9.5 added due to revised estimate + .3 other changes."		"prel."			
6. <u>Burner Nozzles and Manifolds</u>	"13.4"				
(a) Pistle nozzles			-5		
"(b) Shorten burner can retaining pins"			prel.		
"Note: -2.9 revised estimate"		"(-1.0 incorporated)"			
7. <u>Burner Case</u>	"149.7"				
(a) Thin burner can supports		"(-4.8 incorporated)"			
(b) Remove rear burner clamps and flange		-5			
(c) Annular burners		prel.			
"(d) Hot cone burner with 5 in. length reduction"					"-63"
"Note: +.1 revised estimate +.6 other changes."					"prel."
					"-40"
					"prel."
8. <u>Outer Burner Case</u>	"92.1"				
(a) Reduce flanges and bolts		(proposal dropped)			
(b) Astroloy burner case					"-3"
(c) Lighten drain bosses		"(-1.0 incorporated)"			

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		<u>Cat. 1</u>	<u>Cat. 2</u>	<u>Cat. 3</u>	<u>Cat. 4</u>
"(d) Reduce case to .048 with reduced maneuver loads"		"-7.8"			
"Note: +3 revised estimate"		"prel."			
9. <u>Inner Burner Case</u>	"68.6"				
(a) Thin inner burner case corrugated stiffener to .010			-5 prel.		
(b) Thin diaphragm		"-1.1"			
"Note: +6.8 added due to transfer of parts from Section 12. +3.6 added revised estimate."		"prel."			
10. <u>Burner Miscellaneous</u>	"8.6"				
"Note: -13 transfer of parts to Section 11."					
11. <u>Transition Ducts</u>	"100.0"				
(a) Thin outer duct from -.71 to .056" min.		-9			
"Note: +13 transfer of parts from Section 10, +.3 revised estimate."					
12. <u>Turbine Engines</u>	"282.6"				
(a) Redesign transition duct to nozzle seals			-15.		
(b) Replace 1st stage vane liner with tube		"(-4.4 incorporated)"			

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		<u>Cat. 1</u>	<u>Cat. 2</u>	<u>Cat. 3</u>	<u>Cat. 4</u>
"(c) Remove external tube from 1st stage vane"				"NA"	
"Note: -6.8 due to parts transfer to Section 9."					
13. <u>Turbine Case</u>	"2.7"				
"Note: + .3 revised estimate"					
14. <u>Turbine Rotor</u>	"671.0"				
(a) Redesign blade root to exploit Astroloy (1st stage)		-29 prel.			
(b) Thin rotor flanges and pilots					(proposal dropped)
(c) Thin turbine shaft seals		"(-2.1 incorporated)"			
(d) Thin 2nd stage rotor rear seal		"(-.2 incorporated)"			
(e) Thin balance flange on turbine shaft		"(-3.3 incorporated)"			
(f) Redesign 2nd stage root to exploit Astroloy		-5.6 prel.			
(g) Eliminate 1st stage cover plate and duct					"-15"
"(h) Corrugated turbine shaft cooling duct"				"(-2.9 incorporated)"	
"Note: -1.8 revised estimate"					

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15. <u>Turbine Exhaust</u>	"402.9"				
(a) Sandwich const. inner turbine exhaust duct					"(dropped)"
(b) Thin turbine exhaust struts to .032 min. (incorporated prior to last report)		(-2.8 incorporated)			
(c) Thin outer turbine exhaust ducts to .038 min.		"(-6.3 incorporated)"			
(d) Astroloy rear mount ring					-10** prel.
(e) Thin turbine exhaust case rear flange		"(-5.2 incorporated)"			
(f) Thin #3 bearing support flange					"(dropped)"
(g) Redesign #3 bearing and bearing compartment					-3** prel.
(h) By-pass bleed re-entry		"(-4 incorporated)"			
"(i) Redesign turbine exhaust struts for cost reduction and weight if possible"				"-3.0" "prel."	
"(j) Corrugate re-entry fairing"		"-8.0"			
"(k) Corrugate inner duct"		"-4.0"			
"(l) Revise exhaust vane bolts"		"(-1.0 incorporated)"			
"(m) Reduce mount ring with reduced maneuver loads		"-5.0" "prel."			
"Note: +6.3 revised estimate					

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		<u>Cat. 1</u>	<u>Cat. 2</u>	<u>Cat. 3</u>	<u>Cat. 4</u>
16. <u>Turbine Miscellaneous</u>	"5"				
"Note: -7 revised estimate"					
17. <u>A/B Diffuser Section</u>	"120.5"				
(a) Thin case to .032 min. Reduce flanges and bolts			"-3"		
			"(-6 incorporated)"		
(b) Sandwich construction inner cone and diaphragm					-8
(c) A/B Variable area fuel nozzles "(Associated fuel control parts transferred to Item 26 b.)"			"(-22.9 incorporated)"		
"Note: -16.6 revised estimate"					
18. <u>A/B Ducts and Liners</u>	"239.4"				
(a) Thin ducts			"(-11.5 incorporated)"		
(b) Scallop flanges and reduce bolt sizes			"(-1.1 incorporated)"		
(c) Substitute Astroloy sheet in duct					"(dropped)"
"(d) Redesign nozzle air seals"					"-10.0"
"Note: -5.4 revised estimate"					
19. <u>A/B Nozzle</u>	"412.0"				
(a) Reduce bolt sizes			(proposal dropped)		
(b) Waspaloy A/B nozzle support cone			"(-3.4 incorporated)"		
(c) Lighten nozzle segment rollers					

Item	Current	Proposed Changes (lbs.)			
	Est. Wt. (lbs.)	Cat. 1	Cat. 2	Cat. 3	Cat. 4
(d) Lighten nozzle segments with FOEL-100		"(-25.0 incorporated)"			
(e) Thin support front flange		"(-2.7 incorporated)"			
"(f) Study alternate nozzle designs"					"NA"
"(g) Reduce primary flap structure (birdcage)"		"-15"			
"Note: -11.6 revised estimate"					
20. <u>A/B Actuating System</u>	"50.8"				
(a) Lighten A/B nozzle actuators					NA
(b) Remove A/B actuator, use 3					(proposal dropped)
"Note: +3.4 revised estimate."					
21. <u>A/B Miscellaneous</u>	"0"				
"Note: -7.0 revised estimate."					
22. <u>Hydraulic System</u>	"111.8"				
"Note: +4.9 revised estimate"					
23. <u>Ignition System</u>	33				
"(a) Remove probes with manifold injection"					"NA"



Item	Current Est. Wt. (lbs.)	Proposed Changes (lbs.)			
		Cat. 1	Cat. 2	Cat. 3	Cat. 4
24. <u>Accessories Drive</u>	"115.8"				
(a) Gearbox		"(-1.4 incorporated)"			
(b) Change to Ti covers and supports					"(dropped)"
"Notes: +.2 revised estimate +.5 other changes."					
25. <u>Engine Accessories</u>	"311.1"				
(a) Lighten lube pump with Ti sheet housing					-3 prel.
(b) Titanium P & D valve housing					-2 prel.
(c) Titanium lube tank					-1.5 prel.
(d) Change to controlled tubing					
"(e) Aluminum lube pump body"		-5 prel.		"1A"	
"Notes: +4.5 revised estimate +2.2 other changes."					
26. <u>A/B Accessories</u>	"223.0"				
(a) Single stage A/B fuel pump		-4 prel.			
"(b) Revise control for variable orifice nozzles (was part of Item 17 c)"					
Partial re-design		-6"			
Complete re-design					-14"
"(c) Revise pump for variable orifice nozzle"					-5"
"(d) Revise plumbing for variable orifice nozzles"		-10" "prel."			

Item	Current Est. Wt. (lbs.)	Proposed Changes (lbs.)			
		Cat. 1	Cat. 2	Cat. 3	Cat. 4
"Note: +9.0 revised estimate. -3.6 control reduction."					
27. <u>By-Pass System</u>	"261.7"				
(a) By-pass mechanism and ducts			-15 prel.		
(b) Eliminate front transition ducts			-38 prel.		
"(c) Eliminate synchronizing ring"			"-17.6"		
"Note: -10.9 revised estimate +17.6 incorporate synchronizing ring (c)"					
28. <u>Experience Factor</u>	20				
Revision in Waspaley density					
ADDITIVE TOTALS	"5880.2"	"-162.9"	"-95.6"	"-3.0"	"-290.5"

25X1D

- CODES : (1) Prel. = Preliminary estimate not substantiated by design layout.
- (2) EA = Weight estimate not yet available.
- (3) \* = [REDACTED] capability subject to compromise.
- (4) \*\* = Costly material change involved.
- (5) " " = Revisions since 1 July 1960.

- NOTES : (1) Incorporated changes shown in parentheses do not contribute toward the total of outstanding changes for that category.
- (2) The change reflected in comparing weight estimates under current Estimated Weight column of this tabulation with the previous Revision A tabulation does not equal the summation of the incorporated changes for the section because of the effect of revised estimates and incorporation of other changes which are shown as Notes under the column headed Item.
- (3) The totals shown for categories 1 through 4 reflect outstanding changes which have not been incorporated.

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